

New records and new species of *Calliotropis* (Gastropoda: Chilodontidae: Calliotropinae) from Madagascar, Mayotte Island and Reunion Island

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ABSTRACT. New records of *Calliotropis* species from the western Indian Ocean are listed. Some Indo-Pacific species are recorded for the first time in the Madagascar area. *Calliotropis velata* n. sp., *C. ericius* n. sp., *C. bucina* n. sp., *C. babylonia* n. sp., and *C. solariellaformis* n. sp. are described and compared with similar *Calliotropis* species.

RESUME. De nouveaux relevés de *Calliotropis* provenant de l'Océan Indien occidental sont listés. Des espèces décrites de l'Indo-Pacifique sont enregistrées pour la première fois dans la région de Madagascar. *Calliotropis velata* n. sp., *C. ericius* n. sp., *C. bucina* n. sp., *C. babylonia* n. sp. et *C. solariellaformis* n. sp. sont décrites et comparées avec des espèces analogues de *Calliotropis*.

INTRODUCTION

The deep-water fauna of the western and south-western parts of the Indian Ocean remains poorly known. The German Valdivia expedition (1898-99) carried a number of deep-water operations off what was then German East Africa; the gastropods were studied by Martens & Thiele (1904) and Thiele (1925).

Later, the John Murray expedition (1933-1934) sampled the Gulf of Aden and NW part of the Indian Ocean; the gastropod material (in BMNH) has never been reported as such, but scattered records appear in various taxonomical papers (e.g., Bouchet & Warén, 1988; Bouchet & Sysoev, 2001). In the 1980s, as a by-product of commercial shrimp trawling off Somalia, a number of molluscs were brought into the hands of shell dealers and collectors, and new species were described from depths of 150-300 m.

South African waters, from Natal southwards, have received more attention, with deep-water surveys carried for fisheries or biodiversity purposes since the end of XIXth century (see Kilburn, 1999). The Cape and Natal Governments commissioned s.s. Pieter Faure for benthic trawling in 1897-1901; the collected material was first studied by Sowerby III (1892), later by Barnard (1963) who described many new species from South Africa. This author noted that coasts from Natal and Zululand are washed by the southward flowing Mozambique current and that consequently records of Indo-Pacific species could be possible. More recently, the Natal Museum Dredging Programme (1981-1996) provided a large sampling of continental shelf and slope molluscs of the Transkei

and Zululand areas (Kilburn & Herbert, 1994); part of this material was studied by Kilburn (e.g. 1973, 1977) and Herbert (e.g. 1987, 1991, 1992, 1993).

The present paper is based on deep-water material from the Madagascar region brought together in MNHN from various sources. Surveys for deep-water shrimp fisheries were carried out in 1971-73 on R.V. "Vauban" by Dr A. Crosnier, then at ORSTOM (Office de la Recherche Scientifique et Technique d'Outre-Mer - now IRD: Institut de Recherche pour le Développement) (Crosnier & Jouannic, 1973). As a by-product of these surveys, Crosnier submitted mollusc material for identification to Dr Tucker Abbott (then at ANSP), who himself loaned it to Dr R. Kilburn (Natal Museum); in the late 1980s, this material was finally sent to Dr P. Bouchet for final repository in MNHN. Surveys for commercial shrimp stocks resumed in 1987-88 and Dr R. von Cosel also obtained molluscs as a by-product on board of the commercial trawler "Mascareignes III".

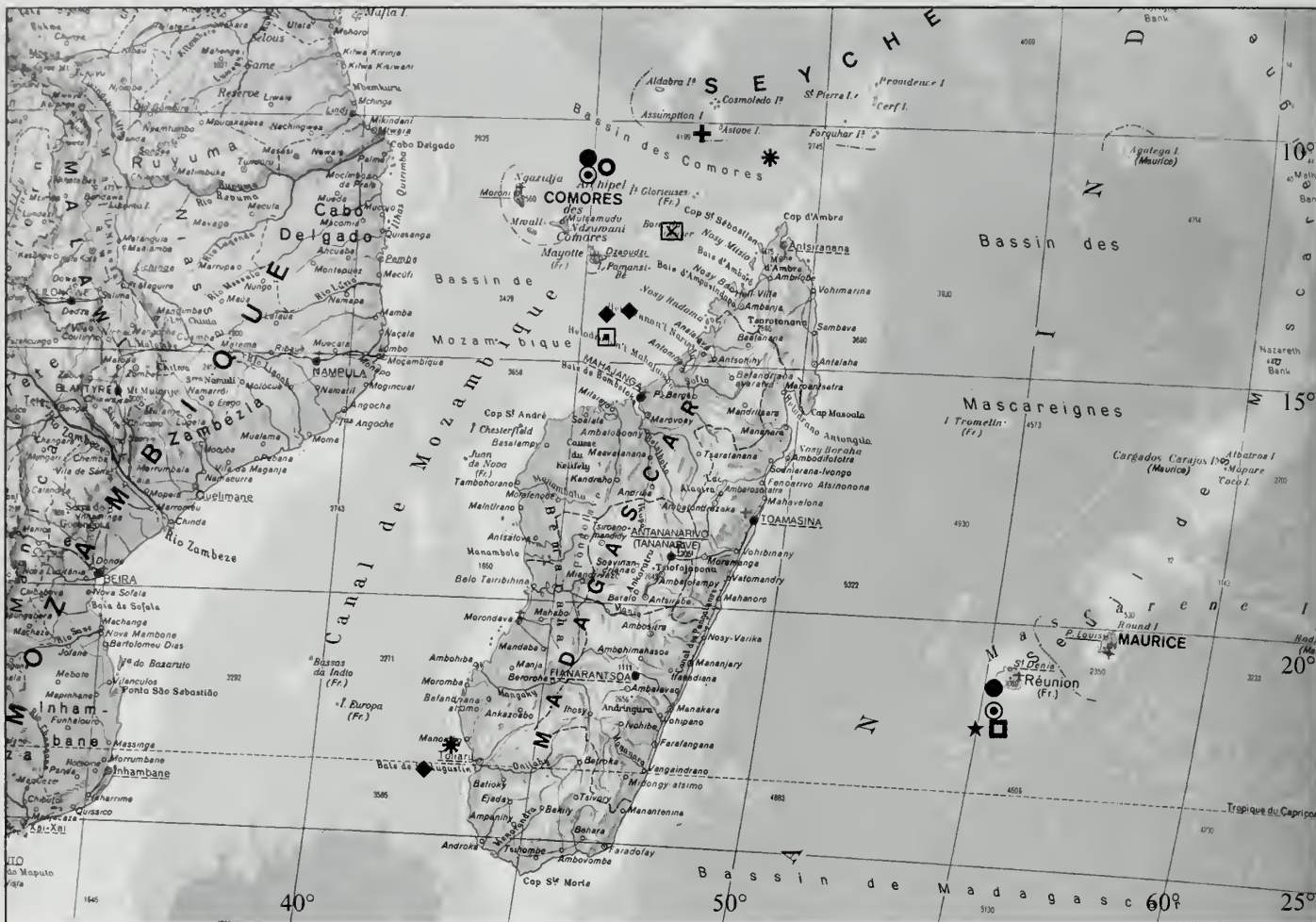
Beside these fisheries surveys, two biodiversity surveys were conducted in the area.

The BENTHEDI expedition was conducted in 1977 aboard R.V. *Noroit*, with Dr B. Thomassin (CNRS: Centre National de la Recherche Scientifique) as Principal Investigator and Dr P. Bouchet as malacologist; it surveyed the northernmost part of the Mozambique Channel between Madagascar and the island of Mayotte, from subtidal depths to 3600 meters.

The MD-32 was conducted in 1982 aboard R.V. *Marion-Dufresne*, with Dr A. Guille as Principal Investigator and Drs P. Bouchet, B. Métivier and A. Warén as malacologists; it surveyed the slopes of

Reunion I., from subtidal depths to 4000 meters. Further deep-water specimens from off Reunion were obtained in the 1980-90s in traps baited for shrimps, and this material ended up with private collectors (J.C. Martin, J. Drivas, M. Veillard, M. Jay, G. Hoareau) or in MNHN through the courtesy of M. Kopp, the local officer of the Fisheries Institute (ISTPM, later IFREMER : Institut français de recherche pour l'exploitation de la mer - French Research Institute for Exploitation of the Sea).

Gastropods from these sources have been published in scattered taxonomical papers (e.g., Bouchet, 1988; Warén & Bouchet 1986, 1990; Bouchet & Kantor, 2000; Kantor, Bouchet & Oleinik 2001; Vilvens 2001, 2002, 2005; Vilvens, Nolf & Verstaeten 2004). The present paper reports new records and new species of *Calliotropis* collected during the BENTHEDI and MD-32 expeditions.



Map 1 : Records of cited *Calliotropis* species - ◆ : *C. velata*; □ : *C. pulvinaris*; + : *C. hataii*; ● : *C. ericius* ; * : *C. eucheloides*; ☒ : *C. metallica*; ⊙ : *C. bucina*; ⊖ : *C. acherontis*; ◻ : *C. babylonia*; ★ : *C. solariellaformis*.

Repositories

- AMS: Australian Museum, Sydney, Australia.
- IRSNB: Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgium.
- MNHN: Muséum national d'Histoire naturelle, Paris, France.
- NMNZ: Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand.
- RMBR: Raffles Museum of Biodiversity Research, Singapore.

ZMA: Zoölogisch Museum, Amsterdam, The Netherlands.

Other abbreviations

- H: height
- W: width
- HA: height of the aperture
- P1, P2, P3, ... : primary cords (P1 is the most adapical)
- S1, S2, S3, ... : secondary cords (S1 is the most adapical)

stn : station

lv: live-taken specimens present in sample

dd: no live-taken specimens present in sample

sub: subadult specimen

juv: juvenile specimen

Remark about distribution ranges

Regarding the distribution of the new species and the extension of the distribution of known species, the range is taken from the internal intervals of the two extremes values.

SYSTEMATICS

We follow here the classification of Bouchet & Rocroi (2005), where Calliotropini, earlier treated as a tribe of Trochidae (Hickman & McLean, 1990), are now ranked as a subfamily of family Chilodontidae.

Superfamily SEGUENZIOIDEA Verrill, 1884

Family CHILODONTIDAE Wenz, 1938

Subfamily CALLIOTROPINAE Hickman & McLean, 1990

Genus *Calliotropis* Seguenza, 1903

Type species: *Trochus otto* Philippi, 1844 (by original designation) – Pliocene-Pleistocene, Italy.

Calliotropis velata n. sp.

Figs 1-7

Type material. Holotype (20.2 x 24.9 mm) MNHN (Moll 5804). Paratypes: 3 MNHN (Moll 5805, Moll 5806, Moll 5807), 1 IRSNB (IG nr 30 548 539), 1 RMBR (ZRC.MOL.99), 2 coll. G. Poppe, 2 coll. C.Vilvens.

Type locality. Western Madagascar, Chalutages *Vauban*, stn CH49, 15°18.3'S, 46°10.3'E, 500-550 m.

Material examined. Western Madagascar.

Chalutages *Vauban*: stn CH49, 15°18.3'S, 46°10.3'E, 500-550 m, 1 dd (holotype). - Stn CH65, 23°35'S, 43°28.6'E, 740-760 m, 1 dd (paratype). - Commercial dredgings, off Mahajanga (formerly Majunga), trawlers said to be from 800 m, 15 dd (whom 8 paratypes).

Distribution. Western Madagascar, 550-800 m.

Diagnosis. A *Calliotropis* species with moderately high spire, conical shape, whitish, with 2 granular cords on spire whorls and 3 granular spiral cords on last whorl, the granules of the adapical cord being the strongest; broad umbilicus sometimes covered by a thin septum; 4 or 5 granular spiral cords on base.

Description. *Shell* rather tall for the genus (height up

to 21.3 mm, width up to 25.7 mm), wider than high, moderately thick, roundly conical; spire moderately high, height 0.8x to 0.9x width, 2.6x to 3.6x aperture height; umbilicus deep and large.

Protoconch more or less 500 µm, of about 1 whorl, smooth, glassy, with a weak, poorly visible, straight terminal varix.

Teleoconch up to 7.5 slightly convex whorls, bearing 3 spiral granular cords and prosocline threads only visible on first whorls; nodules from cords produced by intersections with axial folds on 5 first whorls. Suture visible, not canaliculated.

First whorl convex, sculptured by about 25 weakly prosocline smooth ribs, interspace between ribs 1.5x broader than ribs; primary spiral cord P1 appearing almost immediately, P2 appearing about half a whorl later, both bearing rounded nodules, evenly distributed; P1 first stronger than P2, becoming similar in size and shape at end of whorl. On second whorl, P1 and P2 stronger; axial ribs more prosocline; subsutural ramp horizontal. On third whorl, nodules of P1 and P2 becoming sharp; P3 weakly emerging from suture, with nodules smaller than nodules of P1 and P2; axial ribs broader, interspace between ribs becoming twice as broad as them. On fourth whorl, nodules of P1 and P2 much stronger; nodules of P3 smaller, twice more numerous than nodules of P1 and P2; subsutural ramp still almost horizontal. At end of fifth whorl, nodules of P1 becoming stronger than nodules of P2; axial ribs becoming obsolete; subsutural ramp oblique. On sixth whorl, nodules of P1 clearly less numerous than nodules of P2; axial ribs disappearing. On last whorl, P1 clearly the strongest, P3 the weakest, peripheral; distance between P2 and P3 slightly smaller than between P1 and P2.

Aperture elliptic, sometimes weakly horizontally elongated, flaring in fully mature shells; outer lip thin, indented by external spiral cords, producing an obtuse angle with inner lip.

Columella curved at top, almost straight, prosocline, without tooth.

Base moderately convex, with at least 4 main granular spiral cords, most often with a fifth cord similar in size between two innermost ones, sometimes with a sixth cord resulting from split of the innermost cord; innermost one stronger than the others, with strong nodules, bordering umbilicus; other cords more or less granular; numerous thin, weak, poorly visible axial lamellate threads between cords; interspace between cords twice as broad as cords.

Umbilicus wide, diameter measuring ca. 30% of shell width, with almost vertical wall and crowded thin axial lamellae, without spiral cord, sometimes covered by a thin transparent septum.

Colour of protoconch and teleoconch off-white, without maculation.

	TW	H	W	HA	H / W	H / HA
holotype	7.5	20.2	24.9	7.2	0.81	2.81
paratype MNHN 1	6.7	13.6	16.4	5.2	0.83	2.62
paratype MNHN 2	7.5	21.3	25.0	6.6	0.85	3.23
paratype MNHN 3	7.0	20.6	22.7	6.9	0.91	2.99
paratype IRSNB	7.1	21.3	25.0	6.9	0.85	3.09
paratype RMBR	7.3	20.4	24.4	5.6	0.84	3.64
paratype GP 1	7.0	20.1	23.9	6.6	0.84	3.05
paratype GP 2	7.4	21.0	25.0	6.6	0.84	3.18
paratype CV 1	7.5	21.0	25.7	8.0	0.82	2.63
paratype CV 2	6.5	20.8	25.4	6.4	0.82	3.25

Table 1. - *Calliotropis velata*: shells measurements in mm for types.

Discussion. Regarding the septum covering the umbilicus in some specimens, it seems that there is no fair correlation between this feature and the size of the shell, the full maturity of the specimen or an expanded outer lip: one can find in the examined sample large specimens without this septum and, on the contrary, small specimens with only 6 whorls that already show a concealed umbilicus.

Regarding allied species, *Calliotropis velata* n. sp. is close to *C. micraulax* Vilvens, 2004 (Figs 8-9) from New Caledonia and Vanuatu, but this similar in size species has a more conical shape with an horizontal subsutural ramp and P2 producing a carena, shows strong prosocline axial threads between cords on last whorls and has smaller more numerous nodules on P2 and P3.

The new species may also be compared to *C. vaillanti* (Fischer, 1882) (Figs 10-11) from north-eastern Atlantic, but this species is smaller, has a cyrtocoidal shape, a transversally elongated aperture and a widely flared umbilical area.

C. velata n. sp. is also superficially similar to *C. glypta* (Watson, 1879) (Figs 12-13) from New South Wales, but this Australian species has a cyrtocoidal shape, more convex whorls, a thinner P1 divided in two parts, axial somewhat scaly threads still visible on last whorls and a more elongated aperture.

Regarding the number of cords on the whorls and on the base, *C. velata* n. sp. may be compared to *C. concavospira* (Schepman, 1908) (Figs 28-29) from Indonesia, but this species is more depressed, has a cyrtocoidal shape, a canalculated suture, nodules

of cords thinner and a proportionally broader umbilicus.

The new species also weakly resembles to *C. regalis* (Verrill & Smith, 1882) from north-western Atlantic, but this species has a more elevated spire, a subsutural spiral cord thinner than the others and more numerous spiral cords on the base. Also *C. velata* n. sp. remembers *C. aeglees* (Watson, 1879) from the same area, but this much smaller species has a more elevated and more conical spire with only 3 spiral cords on the base.

Etymology. Concealed (Latin) - with reference to the umbilicus covered by a septum on some specimens.

Calliotropis pulvinaris Vilvens, 2005

Figs 14-15

Calliotropis pulvinaris Vilvens, 2005: 50-53, figs 1-6, tab 1. Type locality: western Madagascar, 640-660 m.

Material examined. Western Madagascar.

Chalutages *Vauban*: stn CH49, 15°18.3'S, 46°10.3'E, 500-550 m, 1 dd sub.

Distribution. Western Madagascar, 550-800 m (range computed using also the material examined by Vilvens, 2005).

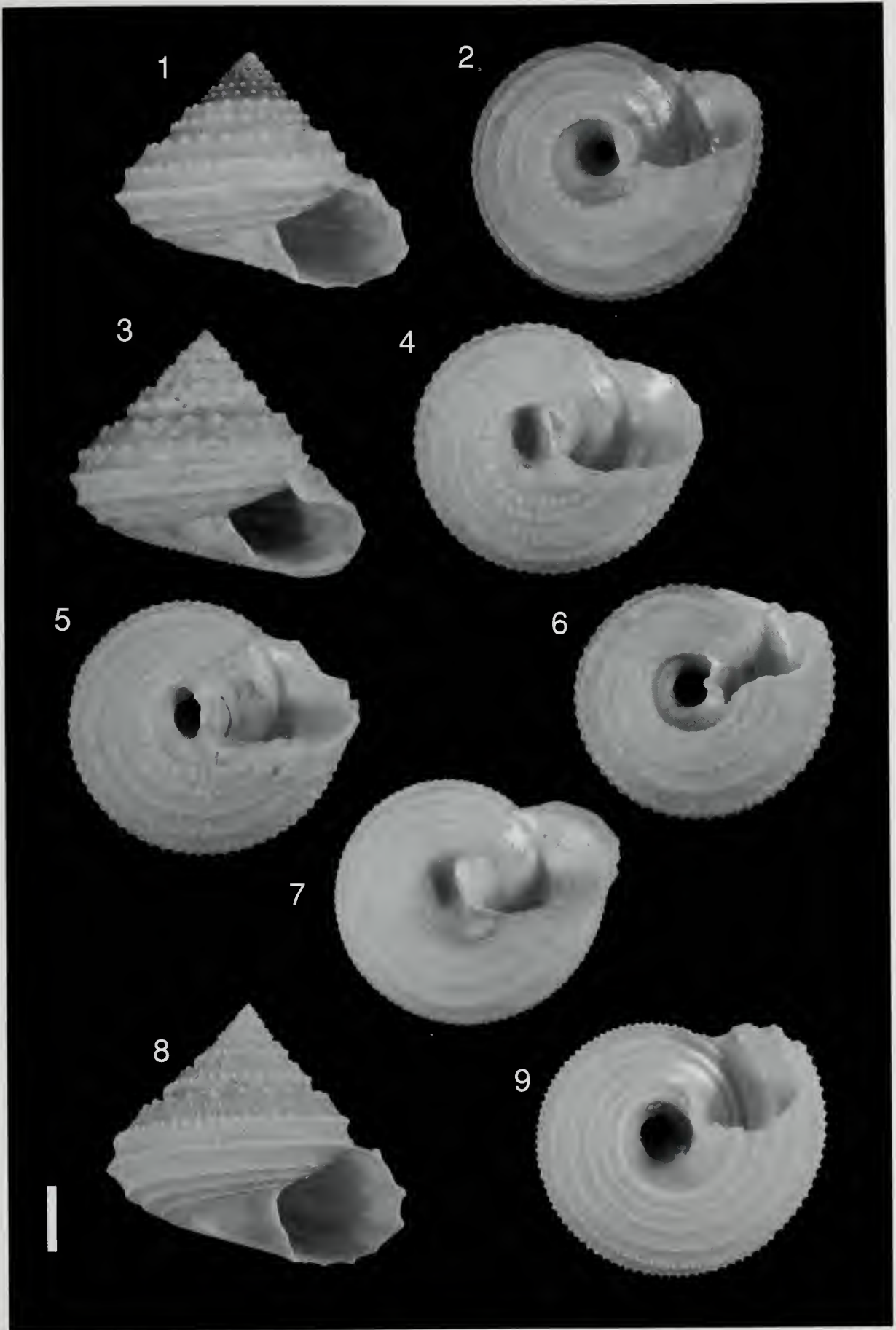
Remarks. This species was described from a area similar to the distribution area of *C. velata* n. sp., using material coming from the same dredgings. This only additional specimen shows 6 spiral cords on the base instead of 5.

Figures 1-9 (Scale bar: 5 mm)

1-7. *Calliotropis velata* n. sp., western Madagascar.

1-2. Holotype MNHN (Moll 5804), 500-550 m [Chalutages *Vauban*, stn CH49], 20.2 x 24.9 mm; **3-4.** Paratype MNHN (Moll 5805), 800 m, 21.3 x 25.0 mm; **5.** Paratype RMBR (ZRC.MOL.99), 800 m, 20.4 x 24.4 mm; **6.** Paratype MNHN (Moll 5807), 800 m, 20.6 x 22.7; **7.** Paratype C.Vilvens coll., 800 m, 20.8 x 25.4 mm.

8-9. *C. micraulax* Vilvens, 2004, holotype MNHN, southern New Caledonia, 1060-1450 m [BATHUS 2, stn CP767], 20.1 x 21.7 mm.



Calliotropis hataii Rehder & Ladd, 1973

Figs 16-17

Calliotropis hataii Rehder & Ladd, 1973: 43-44, figs 16-18. Type locality: central Pacific (Iles Guyot).

Material examined. Western Madagascar.

BENTHEDI: stn 87, 11°44'S, 47°35'E, 3716 m, 1 dd & 1 dd juv.

Distribution. Central Pacific, 1617-1719 m. Now extended to south-western Indian Ocean, 3716 m.

Remarks. This species was described from Central Pacific Ocean. It is unknown whether the disjoint distribution (Central Pacific and south-western Indian Ocean) is real or results from inadequate sampling in transitional regions, in particular western Australia. If it proved real, the taxonomic identity of the south-western Indian Ocean material should be re-examined, also using molecular characters. For the time being, all examined specimens show the same ontogeny of cords (the only slight difference of Madagascan specimens with Pacific specimens is an additional spiral cord on the base, giving a number of 5 cords instead of 4) and so it seems appropriate to apply the name *C. hataii* to that material.

Calliotropis ericius n. sp.

Figs 20-21

Type material. Holotype (4.7 x 4.1 mm) MNHN (Moll 5808). Paratype (2.8 x 2.4 mm) MNHN (Moll 5809).

Type locality. Northern Mozambique Channel, Mayotte Island, BENTHEDI, stn 40, 12°56'S, 45°18.2'E, 1300-1480 m.

Material examined. Mayotte Island. BENTHEDI: stn 40, 12°56'S, 45°18.2'E, 1300-1480 m, 1 dd (holotype). – **Reunion Island.** MD32/REUNION: stn DS139, 20°47'S, 55°38'E, 1575-1600 m, 1 dd sub (paratype).

Distribution. Mayotte Is., 1300-1480 m and Reunion Is., 1600 m.

Diagnosis. A roundly conical shell, rather high

elevated, whitish, with a large and deep umbilicus, 6 prickly spiral cords on last whorl, a deeply excavated sutural area and 6 granular spiral cords on base.

Description. *Shell* small for the genus (height up to 4.7 mm, width up to 4.1 mm), higher than wide, roundly conical; spire high, height about 1.1x width, 3.5x to 4.2x aperture height; umbilicus deep and rather large.

Protoconch about 200 µm, of about 1.1 whorl, smooth, glassy, bulbous, with a thick straight terminal varix.

Teleoconch of 5.5 convex whorls, bearing prosocline threads and spiral granular cords; sharp nodules from cords produced by intersections with axial folds on first three whorls. Suture visible, weakly canaliculated.

First teleoconch whorl convex, sculptured by about 15 slightly prosocline thick smooth ribs, interspace between ribs 1.5 broader than ribs. Primary spiral cord P2 appearing on second whorl, at first third of height of whorl; P1 appearing a little later near the suture; P1 and P2 similar in size and shape, bearing sharp nodules; subsutural ramp horizontal. On third whorl, P3 appearing at second third of height of whorl, quickly as strong as other cords; distance between axial ribs twice as broad as them. On fourth whorl, nodules of cords becoming clearly sharply pointed, the ones of P1 adapically oriented; P2 moving toward middle of whorl. On fifth whorl, secondary cords S1 and S3 appearing, first granular but becoming quickly prickly; S2 absent. On last whorl, P4 peripheral, much weaker than other cords, weakly granular; axial sculpture still visible, connecting nodules of all cords; subsutural ramp still horizontal.

Aperture circular; outer and inner lip thin, without angle.

Columella concave, almost vertical, without tooth.

Base moderately convex, sculptured with 6 granular spiral cords, alternating a weak cord and a stronger one; 3 outermost only weakly granular, 3 innermost more clearly granular; broad axial lamellate threads between cords; interspace between cords twice as broad as cords.

Umbilicus moderately wide but deep, diameter measuring about 15% of shell diameter, with axial lamellae and 4 thin prickly spiral cords within.

Colour of protoconch and teleoconch off-white, without maculation.

Figures 10-19 (Scale bar: 5 mm)

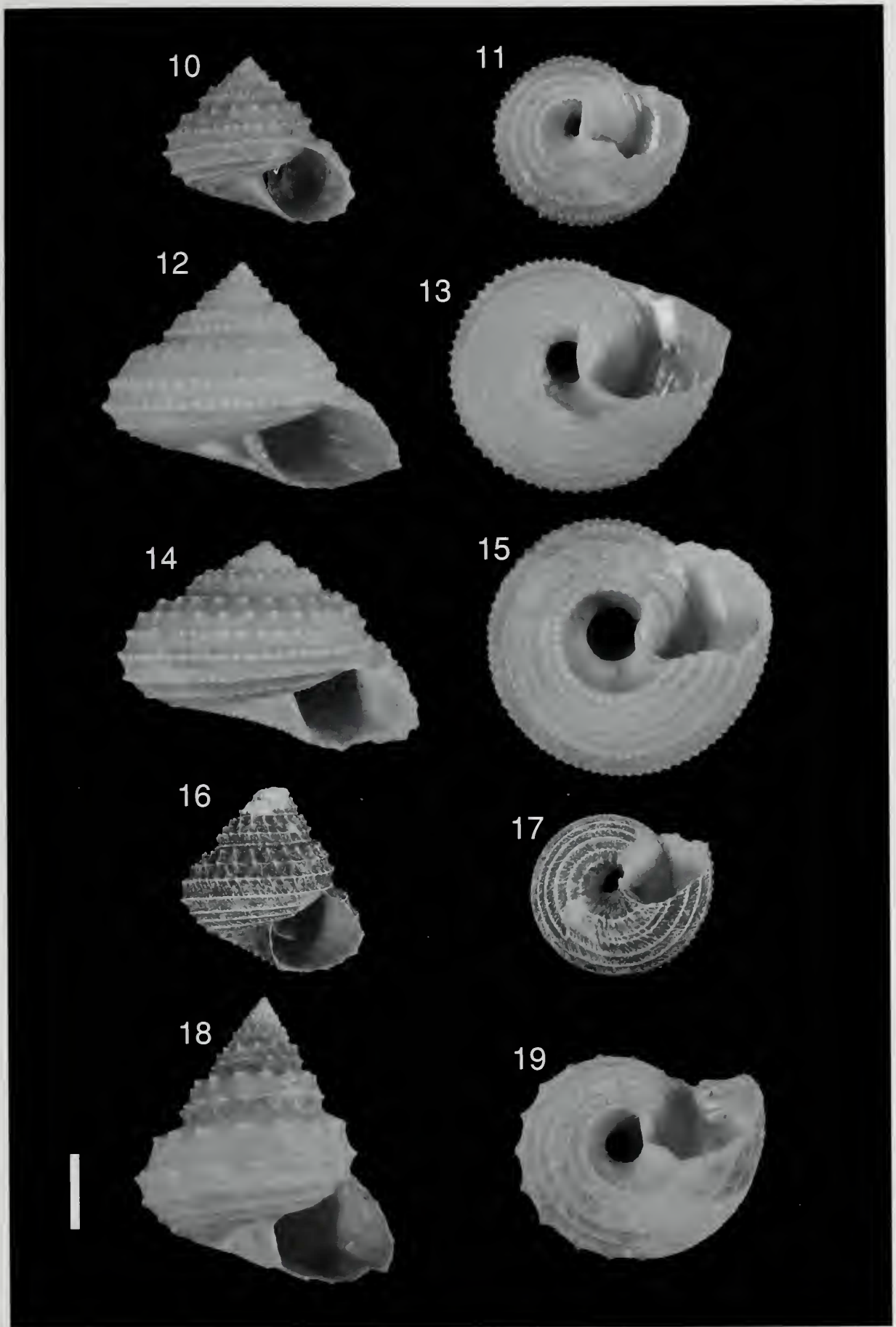
10-11. *Calliotropis vaillanti* (Fischer, 1882), Azores, 1240-1200 m [Mission Biazores, stn 64], 9.8 x 11.0 mm.

12-13. *C. glypta* (Watson, 1879), Australia, New South Wales, 440 m, coll. C. Vilvens, 18.0 x 21.5 mm.

14-15. *C. pulvinaris* Vilvens, 2005, paratype C. Vilvens coll., western Madagascar, 800 m, 18.3 x 25.4 mm.

16-17. *C. hataii* Rehder & Ladd, 1973, western Madagascar, 3716 m [BENTHEDI, stn 87], 12.3 x 12.0 mm.

18-19. *C. metallica* (Wood-Mason & Alcock, 1891), western Madagascar, 850-1125 m [Chalutages *Vauban*], 25.5 x 22.2 mm.



Discussion. Regarding its prickly shape, its ontogeny of the spiral cords of the whorls and the spiral cords in its umbilicus, *Calliotropis ericius* n. sp. only remembers *C. lamellifera* Jansen, 1994 (Figs 22-23) from New South Wales and Queensland, but this similar in size species has a conico-coelocoidal shape, a more elevated spire with an higher H/D ratio, stronger and sharper nodules of spiral cords, no secondary cords on the whorls and only 3 spiral cords on the base.

Etymology. Hedgehog (Latin), used as a noun in apposition - with reference to the prickly nodules of the spiral cords.

Calliotropis eucheloides Marshall, 1979
Figs 24-27

Calliotropis eucheloides Marshall, 1979: 527-528, figs 3A-C, tab 2. Type locality: Kermadec Islands (Raoul Is.).

Material examined. Western Madagascar. P.3 Chalutage 28, 12°42.9'S, 48°12.1'E, 445-455 m, 1 dd. - Chalutage 95, 22°21.6'S, 43°04.3'E, 450 m, 1 dd.

Distribution. South-West Pacific: Kermadec Islands, 366-412 m; New Caledonia, 305-580 m (MNHN, unpublished data); Philippines, 150-300 m. Now extended to south-western Indian Ocean, 450 m.

Remarks. This species was described from Kermadec Islands, but is also found in New Caledonia and Philippines. Again, it is unknown whether the disjoint distribution (south-western Pacific and south-western Indian Ocean) is real or results from inadequate sampling in transitional regions. The only slight differences of the Madagascan examined specimens with Indo-Pacific specimens are a slightly larger size (height up 13.6 mm, width up to 9.4 mm) and a secondary cord S1 appearing a bit later (on the fourth whorl).

It must also be noted that specimens of *C. eucheloides* of the usual size were found in the adjacent area off Natal (Durban) by commercial dredgings (coll. G.Poppe – unpublished data).

Figures 20-29 (Scale bar: 5 mm)

20-21. *Calliotropis ericius* n. sp., holotype MNHN (Moll 5808), Mayotte, 1300-1480 m [BENTHEDI, stn 40], 4.7 x 4.1 mm. **22-23.** *C. lamellifera* Jansen, 1994, holotype AMS (C. 169587), New South Wales, off Sidney, 1106-1143 m, 4.8 x 4.3 mm - Photographs taken by M.Allen, AMS.

24-27. *C. eucheloides* Marshall, 1979, western Madagascar.

24-25. 450 m [P.3 - Chalutage 95], 8.8 x 12.9 mm; **26-27.** 445-455 m [P.3 Chalutage 28], 9.4 x 13.6 mm.

28-29. *C. concavospira* (Schepman, 1908), syntype ZMA (3.08.062), Indonesia, 835 m, 6.0 x 8.7 mm.

Calliotropis metallica (Wood-Mason & Alcock, 1891)
Figs 18-19

Solariella metallica Wood-Mason & Alcock, 1891: 444, figs 12a-b. Type locality: southern India (gulf of Manaar).

Material examined. Western Madagascar. Chalutages *Vauban*, 13°50'S, 47°37'E, 850-1125 m, 1 dd.

Distribution. South Africa (Cape), 1024-2743 m; north-western Madagascar, 850-1125 m; East Africa (Aden), 1840 m; central Indonesia, 918-2029 m.

Calliotropis bucina n. sp.
Figs 30-35

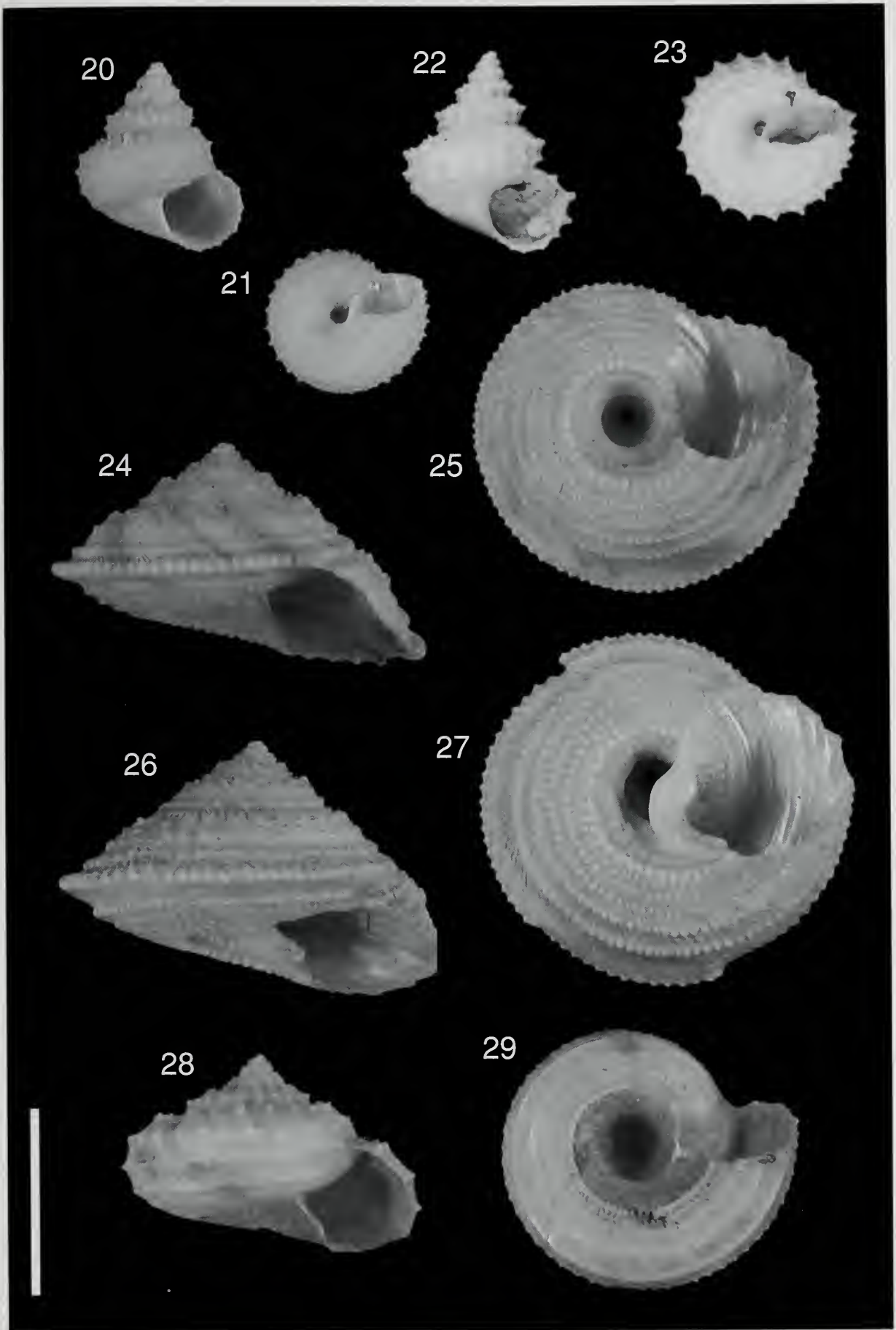
Type material. Holotype (3.7 x 5.4 mm) MNHN (Moll 5810). Paratypes: 8 MNHN (1: Moll 5811; 1: Moll 5812; 6: Moll 5813), 1 IRSNB (IGnr 30 548 540), 1 RMBR (ZRC.MOL.100), 1 coll. C.Vilvens.

Type locality. Reunion Island, MD32/REUNION, stn DC128, 20°51'S, 55°36'E, 280-340 m.

Material examined. Mayotte Island. BENTHEDI: stn 38, 12°54.8'S, 45°15.6'E, 200-500 m, 1 dd juv. - Stn 49, 12°54.6'S, 44°56.8'E, 300-450 m, 1 dd. - Stn 72, 12°31'S, 45°02.3'E, 300-350 m, 2 dd, 2 dd juv. - **Reunion Island.** MD32/REUNION: stn DC26, 20°22'S, 55°47'E, 310 m, 2 dd, 1 dd sub, 1 dd juv. - Stn DC121, 20°53'S, 55°14'E, 290-340 m, 1 dd. - Stn DC128, 20°51'S, 55°36'E, 280-340 m, 12 dd (holotype and 18 paratypes), 4 dd sub, 3 dd juv. - Stn DS173, 20°52'S, 55°37'E, 270 m, 1 dd juv.

Distribution. Reunion Island, 270-310 m and Mayotte Island, 300-350 m.

Diagnosis. A small *Calliotropis* species with rather depressed spire, greyish, shouldered whorls, 5 granular spiral cords on last whorl, the peripheral cord being the strongest and very spiny, 3 granular spiral cords on base and a large umbilicus with 2 spiral granular cords inside.



Description. *Shell* rather small for the genus (height up to 3.8 mm, width up to 5.5 mm), wider than high, rather thin, more or less cyrtocoidal; spire rather depressed, height 0.6x to 0.7x width, 3.1x to 3.8x aperture height; umbilicus deep and large.

Protoconch about 150 µm, of 1 whorl, smooth, glassy, bulbous, with a very weak terminal varix.

Teleoconch of up to 5.5 convex whorls with shoulder at first third, bearing 5 granular spiral cords on last whorl and weakly prosocline threads; nodules from cords produced by intersections with axial folds on 3 first whorls; additional axial threads not connecting nodules on last whorls. Suture visible, weakly canaliculated.

First teleoconch whorl convex, sculptured by about 12 weakly prosocline smooth ribs, interspace between ribs twice as broad as them; primary spiral cord P3 appearing at the end of whorl, bearing rounded nodules. On second whorl, P2 appearing, quickly similar in size and shape to P3; P2 producing a weak shoulder at the end of whorl; at end of whorl or at begin of third whorl, beads of P2 and P3 becoming sharp. At the end of third whorl, thin axial threads appearing on almost horizontal subsutural ramp above P2 and under P3; beads of P3 becoming scaly and stronger than beads of P2. On fourth whorl, P1

appearing, quickly as strong as P2; thin additional axial threads appearing between P2 and P3, similar in size and shape to threads above P1 and under P3, distance between them of same size as threads; nodules of P3 becoming sharp scales, horizontally oriented; S2 appearing at end of whorl. On last whorl, S2 weaker than P1 and P2; P3 the strongest with strong spiny scales, sometimes even hollow spines; P4 emerging from suture, with nodules smaller than nodules of P1 and P2 and more numerous than on P1, P2 and S2; all areas between cords covered by thin prosocline threads.

Aperture subcircular; outer lip thick, round; inner lip with a distinct almost right angle.

Columella straight, prosocline, without tooth, weakly reflected.

Base flat or very weakly convex, sculptured with 3 granular spiral cords; interval between cords similar in size to cords; axial threads between cords, connecting beads of cords.

Umbilicus wide, diameter measuring 20% to 25% of shell width, with axial lamellae and two granular spiral cords inside.

Colour of protoconch white; teleoconch greyish white, without maculation.

	TW	H	W	HA	H / W	H / HA
holotype	5.0	3.7	5.4	1.0	0.69	3.70
paratype MNHN 1	4.8	3.4	5.3	1.1	0.64	3.09
paratype MNHN 2	5.1	3.7	5.4	1.2	0.69	3.08
paratype MNHN 3	4.8	3.4	4.8	0.9	0.71	3.78
paratype MNHN 4	4.8	3.5	5.0	1.1	0.70	3.18
paratype MNHN 5	5.0	3.8	5.2	1.0	0.73	3.80
paratype MNHN 6	4.8	3.6	5.1	1.1	0.71	3.27
paratype MNHN 7	4.8	3.4	5.4	1.0	0.63	3.40
paratype MNHN 8	4.7	3.7	5.5	1.1	0.67	3.36
paratype IRSNB	5.1	3.8	5.5	1.0	0.69	3.80
paratype RMBR	4.8	3.3	5.1	1.0	0.65	3.30
paratype CV	5.0	3.5	5.2	1.1	0.67	3.18

Table 2. - *Calliotropis bucina*: shells measurements in mm for types.

Figures 30-40 (Scale bar: 5 mm)

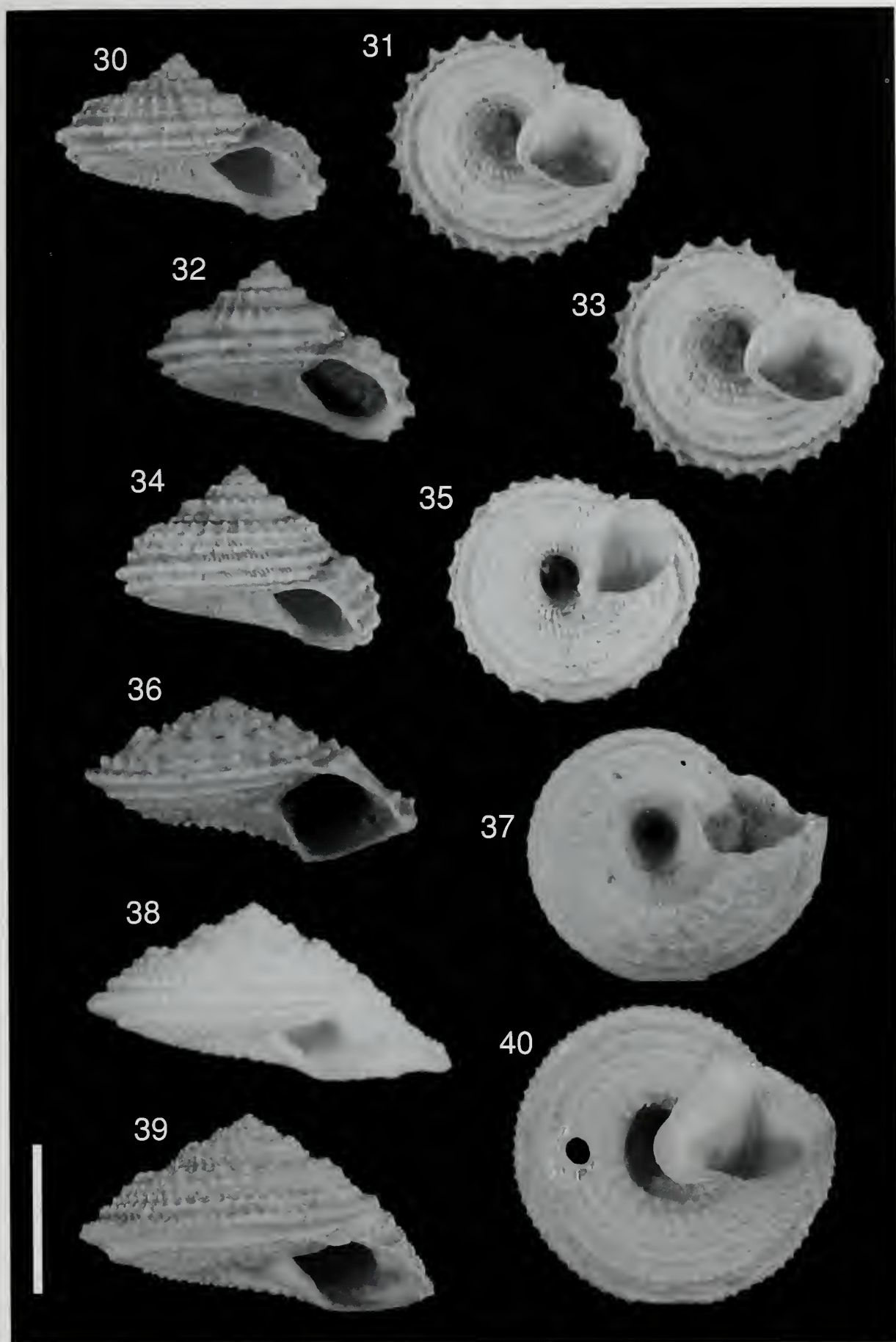
30-35. *Calliotropis bucina* n. sp., Reunion Island, 280-340 m [MD32/REUNION, stn DC128].

30-31. Holotype MNHN (Moll 5810), 3.7 x 5.4 mm; 32-33. Paratype MNHN (Moll 5811), 3.4 x 5.3 mm; 34-35. Paratype MNHN (Moll 5812), 3.7 x 5.4 mm.

36-37. *C. spinulosa* (Schepman, 1908), syntype ZMA (3.08.058), Indonesia, 411 m, 4.3 x 8.8 mm.

38-40. *C. pulchra* (Schepman, 1908), Indonesia.

38. Syntype ZMA, 397 m, 6.5 x 13.0 mm; 39-40. MNHN, Tanimbar Is., 285-297 m [KARUBAR, stn CP83], 7.9x13.3 mm.



Discussion. The combination of a depressed spire, a shoulder at first third of the whorls and a spiral cord P3 with strong spiny scales makes *C. bucina* n. sp. hard to confuse with another *Calliotropis* species. Nevertheless, regarding the depressed and spiny shape, the new species may be compared with *C. spinulosa* (Schepman, 1908) (Figs 36-37) from Indonesia, but this bigger species has only three primary cords, the nodules P1 and P2 being much stronger and the ones of P3 more numerous and not scaly at all.

The new species is also superficially similar to *C. pulchra* (Schepman, 1908) (Figs 38-40) from Indonesia, but this taller species has similar spiral cords with more numerous nodules, the ones from P3 being not scaly but axially elongated, and a trapezoidal aperture.

The spiny shape of *C. bucina* n. sp. also weakly remembers *C. echidna* Jansen, 1994 from New South Wales and Queensland, but this Australian species has a more elevated spire, much bigger nodules on cords, lacks S2 and has a small basal nodule on the columella.

Etymology. Horn, cornet (Latin), used as a noun in apposition - with reference to the cornet shape of the shell seen from the base.

Calliotropis acherontis Marshall, 1979
Figs 44-46

Calliotropis acherontis Marshall, 1979: 529-530, figs 3L-O 9A-B, tab 5. Type locality: Kermadec Islands (Raoul Is.).

Material examined. Western Madagascar, Mayotte Is. BENTHEDI: stn 38, 12°54.8'S, 45°15.6'E, 200-500 m, 10 dd, 1 dd juv. - Stn 64, 12°40.8'S, 45°56.7'E, 770-860 m, 2 dd, 3 dd sub.

Distribution. South-West Pacific: eastern Australia, New Caledonia, Kermadec Islands, 457-1250 m (Jansen, 1994). Now extended to south-western Indian Ocean, 500-770 m.

Remarks. This species was originally described from Kermadec Islands, but appears to have a wider distribution area (at least in New Caledonia area - unpublished MNHN data). Again, it is unknown

whether this disjoint distribution (south-western Pacific and south-western Indian Ocean) is real. All the examined specimens share clearly an ontogeny of cords according with the original description and it seems appropriate to apply the name *C. acherontis* to that material.

Calliotropis babylonica n. sp.
Figs 41-43

Type material. Holotype (7.1 x 5.9 mm) MNHN (Moll 5814). Paratype (7.6 x 5.6 mm) MNHN (Moll 5815).

Type locality. Reunion Island, MD32/REUNION: stn DC64, 21°12'S, 55°04'E, 1150-1180 m.

Material examined. Reunion Island. MD32/REUNION: stn DC64, 21°12'S, 55°04'E, 1150-1180 m, 2 dd, 1 dd sub, 1 dd juv (holotype and paratype).

Distribution. Reunion Island, 1150-1180 m.

Diagnosis. A high spire *Calliotropis* species with 3 granular spiral cords on last whorl, the intermediate cord the thickest, 4 thick granular spiral cords on base and a narrow umbilicus.

Description. *Shell* small for the genus (height up to 7.6 mm, width 5.9 up to mm), higher than wide, rather thin, conoidal in shape; spire height 1.2x to 1.3x width, about 5.4x aperture height; umbilicus narrow and deep.

Protoconch about 400 µm, of 1 whorl, smooth, bulbous, with a slightly curved terminal varix.

Teleoconch of up to 6 convex whorls with shoulder at first third, bearing 3 nodular spiral cords on last whorl and weak to obsolete axial threads; nodules from cords produced by intersections with axial folds on 3 first whorls; additional axial threads not connecting nodules on last whorls. Suture visible, impressed, not canalculated. First teleoconch whorl convex, sculptured by about 20 weakly procline smooth ribs, interspace between ribs as broad as them; primary spiral cords P1 and P3 appearing almost immediately, similar in size, bearing rounded nodules, evenly distributed; P2 absent. On second whorl, P1 moving

Figures 41-50 (Scale bar: 5 mm)

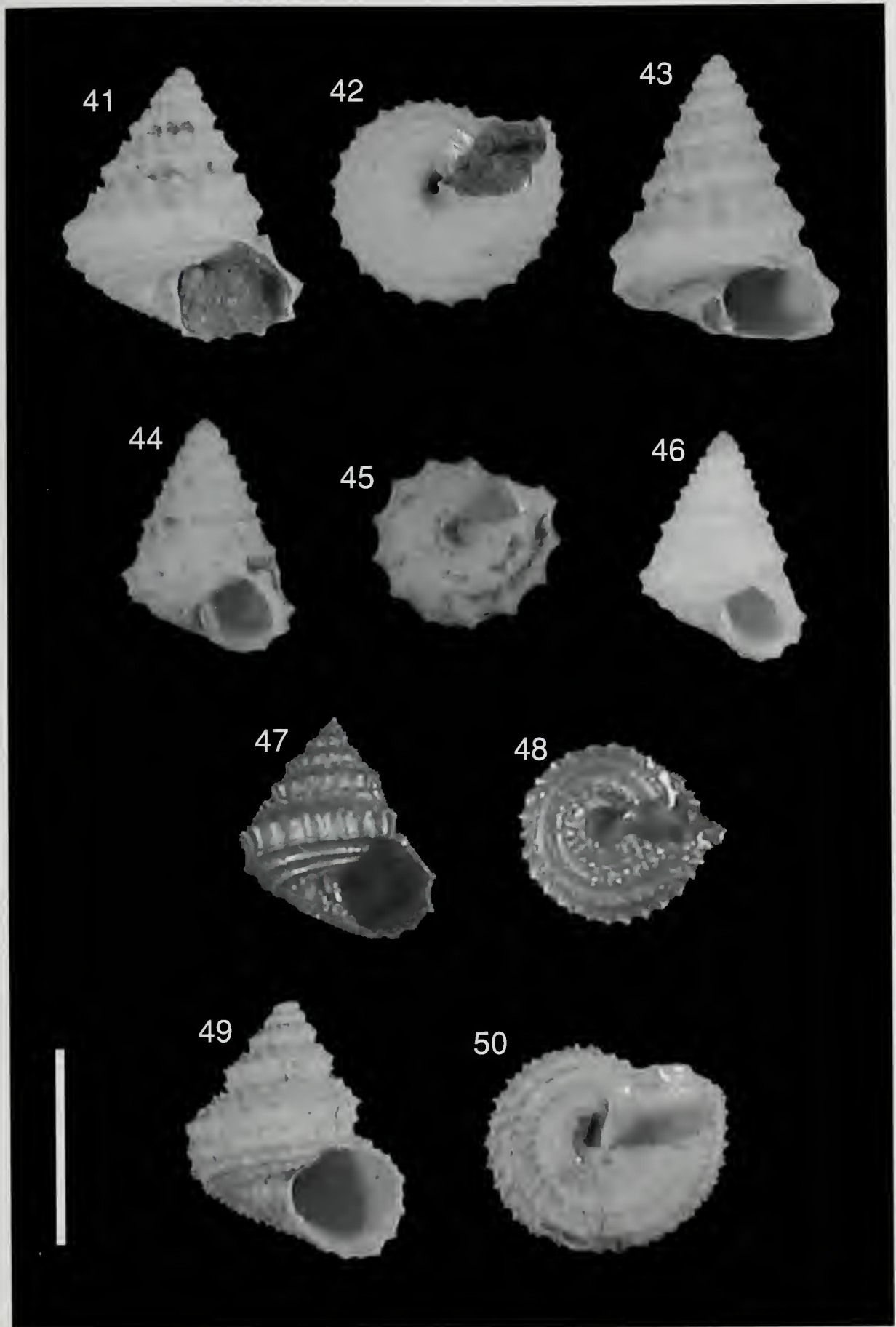
41-43. *Calliotropis babylonica* n. sp., Reunion Is., 1150-1180 m [MD32/REUNION, stn DC64].

41-42. Holotype MNHN (Moll 5814), 7.1 x 5.9 mm; 43. Paratype MNHN (Moll 5815), 7.6 x 5.6 mm.

44-46. *C. acherontis* Marshall, 1979. MNHN, Western Madagascar, Mayotte Is., 200-500 m [BENTHEDI, stn 38. 44-45. 4.5 x 3.2 mm; 46. 4.4 x 3.2 mm.

47-48. *C. crystalophora* Marshall, 1979, holotype NMNZ (M230817), Raoul Island, 512-549 m, 4.0x3.5 mm.

49-50. *C. solariellaformis* n. sp., holotype MNHN (Moll 5816), Reunion Island, 1150-1180 m [MD32/REUNION, stn DC64], 6.0 x 4.9 mm.



towards suture, P3 moving under median line; P3 stronger than P1, with nodules becoming sharp. On third whorl, nodules of P1 and P3 both sharp, nodules of P3 stronger; shape of area between P1 and P3 concave; interspace between ribs twice as broad as them; P4 partially emerging from suture at the end of whorl or at begin of fourth whorl, bearing small weakly sharp nodules; P3 much closer to P4 than to P1. On last whorls, nodules of P1 and P3 becoming larger and more spaced, nodules of P3 slightly stronger; nodules of P4 twice as small as those of P3; axial ribs becoming weak or almost absent. P4 peripheral on last whorl.

Aperture oval, without angle; outer lip rather thin. Columella slightly curved, concave, truncated at base, without tooth, weakly thickened.

Base convex, sculptured with 4 granular evenly distributed thick spiral cords; axial threads between cords weak, connecting nodules of cords; distance between threads of about same size as cords.

Umbilicus narrow, diameter measuring 15% of shell diameter, with axial threads within and without spiral cords.

Colour of protoconch and teleoconch off-white, without maculation.

Discussion. *Calliotropis babylonia* n. sp. is close to *C. acherontis* Marshall, 1979 (Figs 44-46) from Indo-Pacific, but this species is smaller for a similar number of whorls, has 3 (instead of 4) much thinner spiral cords on the base and an umbilicus reduced to a narrow chink.

The new species is also rather close to *C. crystalophora* Marshall, 1979 (Figs 47-48) from Kermadec Islands, but this smaller species has peculiar minute crystals on the whorls and an umbilicus with 1 or 2 spiral cords within.

C. babylonia n. sp. is superficially similar to *C. lamellifera* Jansen, 1994 (Figs 22-23) from Queensland and New South Wales, but this species differs from the new species in having a different general shape, a P2 cord, only 3 cords on the base and several cords in the umbilicus.

The new species weakly resembles to *Echinogurges clavatus* (Watson, 1879) from western Atlantic, but this species has 4 four spiral cords on the body whorl and 5-6 cords on the base.

Etymology. Babylon (Latin), used as a noun in apposition - with reference to the staged shape of the shell, remembering a ziggurat like the Tower of Babel.

Calliotropis solariellaformis n. sp.
Figs 49-50

Type material. Holotype (6.0 x 4.9 mm) MNHN (Moll 5816) dd and 1 paratype (2.4 x 2.0 mm) MNHN (Moll 5817) dd sub.

Type locality. Reunion Island, MD32/REUNION, stn DC64, 21°12'S, 55°04'E, 1150-1180 m.

Material examined. Only known from the type material.

Distribution. Reunion Island, 1150-1180 m.

Diagnosis. A cyrtococonoidal shell with convex whorls, high elevated, with 5 granular to prickly spiral cords on last whorl, 3 granular spiral cords on base and a moderately broad umbilicus with 2 spiral cords inside.

Description. *Shell* of moderate size for the genus (height up to 6.0 mm, width up to 4.9 mm), higher than wide, cyrtococonoidal; spire high, height 1.2x width, about 3.8x aperture height; umbilicus moderately deep and broad.

Protoconch (available only on paratype) about 180 µm, of 1 whorl, smooth, glassy, bulbous.

Teleoconch of 5.5 convex whorls, bearing prosocline threads on first whorls and 5 spiral granular cords; nodules from cords produced by intersections with axial folds on all whorls. Suture visible, not canaliculated.

First teleoconch whorl convex, sculptured by about 18 orthocone smooth ribs, interspace between ribs of 1.5x to 2x width of cords. Primary spiral cord P2 appearing at mid second whorl, P1 a little later; P1 and P2 similar in size and shape, bearing rounded nodules. On third whorl, P2 stronger than P1, nodules of both becoming sharp; P3 appearing, quickly as strong as P1. On fourth whorl, S1 appearing, staying weaker than other cords; P4 emerging partially from suture, with nodules slightly smaller than nodules of P1 and P2; nodules of cords clearly sharp, connected by still visible axial ribs. On last whorls, spiral cords evenly distributed, distance between cords twice as broad as cords; P2 the strongest, producing weak carena; P4 peripheral; S2 may appear at end of last whorl; axial sculpture still visible.

Aperture subcircular; outer lip thin, indented by external spiral cords.

Columella curved, concave, without any tooth or callus.

Base moderately convex, sculptured with 3 main prickly spiral cords and 2 secondary weaker prickly cords between them; axial threads between cords connecting nodules; interspace between cords similar in size to cords.

Umbilicus moderately wide, diameter measuring 20% of shell diameter, with axial lamellae only visible near border and two prickly spiral cords.

Colour of protoconch and teleoconch off-white, with no maculation.

Discussion. The new species is rather close to *Calliotropis niasensis* Thiele, 1925 from Indonesia (Sumatra), but this species, described from probably juvenile specimens, is more depressed and has a more

convex base with more numerous similar in size spiral cords; its umbilicus is also much narrower, apparently without spiral cords within.

C. solariellaformis n. sp. slightly resembles *C. chenoderma* Barnard, 1963 from South Africa, but this species, described also from a probably juvenile specimen with three whorls, is smaller considering the same number of whorls, has more numerous spiral cords (already 6 on the third whorl) without carena on P2 and has an expanded columella.

The new species weakly remember *C. pompe* Barnard, 1963 from South Africa, but this bigger species has only 3 spiral cords on whorls (P2 is lacking), the two abapical cords becoming almost smooth.

Regarding its prickly shape, *C. solariellaformis* n. sp. may be compared to *C. lamellifera* Jansen, 1994 (Figs 22-23) from eastern Australia, but this species is different in having a more angulated shape, much stronger nodules on spiral cords and much thinner spiral cords on the base.

Etymology. With reference to the general shape of shell that remembers the one of *Solariella* species.

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